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An Evaluation of the Competitive Position of Utah Livestock Production to Other Livestock Producing Areas

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AN EVALUATION OF THE COMPETITIVE POSITION OF UTAH LIVESTOCK

PRODUCTION TO OTHER LIVESTOCK PRODUCING AREAS

by

Kenneth H. Gray

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An Evaluation of the Competitive Position of Utah Livestock Production to Other Livestock Producing Areas

by

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Utah State University, 1972

Major Professor: Dr. Paul R. Grimshaw
Department: Agricultural Economics

The purpose of this thesis is to make an evaluation of the competitive position of the Utah livestock industry by use of a linear programming model (MPS-360). This is on the basis of the least cost means of production to meet the quantity demanded of the livestock products. This is accomplished by dividing the United States into six regions where Utah is one of these regions to enable careful consideration of Utah's agricultural enterprises.

The agricultural products used in the analysis are beef, pork, broilers, turkeys, eggs and milk.

The feeds used for production are barley, wheat, corn, oats, milo, hay, and 44 percent soybean meal.

(94 pages)

CHAPTER I

INTRODUCTION

Many of today's crucial agricultural problems in Utah are associated with the livestock industry in the state. Great changes are occuring in production practices, marketing procedures, consumption levels, and expectations of consumers. A study and evaluation of these problems would shed much light on the competitive position of Utah farmers.

The dairy industry has made many adjustments in production in previous years including improved breeding, increased herd size, and fewer dairymen. Although the other livestock industries may not have changed as drastically as dairy, they have certainly made some modifications in the area of production.

Marketing is becoming bigger business. The producer is no longer located at the consumer's front door. Viewed from the demand side, the consumer wants higher quality, more quantity in some areas and less in others, and more variety. His tastes or wants are changing. These changes all transform themselves back to the producer. It is of great importance to be on top of these changes.

The changing product prices and costs are the main determinants of a firm in entering, leaving, or staying in the industry. In the livestock industry the costs would be management, feed, equipment, and alternative use of resources. This makes the livestock industry a competitor on an interregional basis as well as in its own locale. It is essential to consider opportunity costs when making a decision on any of the cost factors.

Utah's competitive position on an interregional basis has many unanswered questions. In Utah, many of the consumed products are produced out-of-state. Can the Utah producer effectively compete with these outside producers? This is not only applicable to the demand in Utah, but also in the out-of-state markets.

Livestock production requires consideration of many intermediate factors. One highly important factor would be feeds; these feeds have to be available for livestock production. This can be accomplished either by transportation from another state or area or raising them locally. The question has to be asked, is it economically feasible; are we raising the most profitable crops for our area, and even then are they profitable? Therefore, this thesis is designed to help enlighten the decision making in agriculture in the State of Utah for the future.

During the year of 1970, 625 thousand tons of feed grain was consumed by livestock in the State of Utah. Only 195 thousand tons of this was produced in Utah. This leaves 430 thousand tons to be raised elsewhere which makes Utah a deficit feed producing state.

Utah is also deficit in producing some livestock products (Table 1). In the consumption of some livestock products the demand exceeded the

Table 1. Livestock products produced and consumed in Utah, 1970 (1)*

Product	Produced	Consumed	Surplus	Average Live Weight (Pounds)
Beef				1,040
No. of Head	258,571	209,104	49,467	
1,000 Pounds	268,914[1]	217,468[1]	51,446[1]	
Pork				229
No. of Head	72,000	421,114	-349,114	
1,000 Pounds	16,488[1]	96,435[1]	- 78,947[1]	
Broilers				3.8
No. of Head	1,206,000	15,656,000	-14,450,000	
1,000 Pounds	4,583[1]	59,493[1]	- 54,910[1]	
Turkeys				21.6
No. of Head	3,943,000	469,618	3,883,567	
1,000 Pounds	85,169[1]	10,143.75[1]	83,884[1]	
Milk				--
1,000 Pounds	834,000	613,002	220,998	
Eggs				--
1,000 Dozens	21,250	27,976	-6,734	

*Source: The computations were done by author based on data obtained from Chicken and Eggs; Eggs, Chickens, and Turkeys; Milk Production, Disposition and Income; Livestock and Meat Statistics; National Food Situation; and Bureau of Census Population Report.

[1]In live weight or live weight equivalent.

NOTE: (1) numbers in parenthesis refer to Literature Cited section, all other enumerations refer to content footnote.

supply on the local market level (Utah). This appears to leave the Utah farmer at an economic advantage at least in the local market in selling these products. This will be true only if the costs of feed grains are relatively equal to other areas of comparison. This study is designed to see how the Utah livestock industry can compete for available markets within Utah as well as markets outside the state of Utah.

Objectives

The objectives of this study are as follows:

(1) A description of the relevant competing production areas. For this study the 48 contiguous states will be arranged by regions.

(2) Calculation of consumption by regions.

(3) Determination of the most economical way to match the consumption (quantity demanded) to the production (supply) and ascertaining the role Utah should play in the livestock and livestock product markets by determining the competitive position of the Utah livestock producers.

CHAPTER II

REVIEW OF LITERATURE

Utah agriculture is concentrated mainly in the livestock and poultry enterprises. The livestock industry in the state of Utah is expanding the size of units with the effect of becoming more capital intensive and labor extensive. If the total number of livestock remains the same and the number of large herds increase while the small herds become fewer in number, it is evident that there would be unemployment in the livestock industry. The only way to counteract this trend of decrease in employment would be to expand the livestock industry in Utah.

There have been many studies made in connection with the livestock industry in Utah. These studies have been concerned with crop and livestock producing enterprises, feed producing and marketing, and fertilizer and machinery. Many of these studies have been done in connection with a regional project for the western states with Utah being only a portion of the area under study. In no case has any Utah study undertaken evaluation of inter-regional competition for the major agricultural products of the State.

An inter-regional competition study involves the competitive position of one area and its ability to compete with other areas in supplying livestock products. The final result will be determined in terms of a comparative advantage rather than an absolute advantage.

There have been some inter-regional projects for certain types of livestock in certain areas carried out in the United States. The main approaches used on these projects to evaluate the competitive position of a certain area vary greatly. The main study that is of most use as background to accomplish this project is a study by Dr. Grimshaw. This study was entitled, "Economic Considerations for Expanded Feeding of Livestock in the Pacific Northwest." Dr. Grimshaw, Associate Dean of the College of Agriculture at Utah State University completed this study as partial fulfillment of the requirements for the degree of Doctor of Philosophy at Oregon State University. To my knowledge it is the only study that used energy units as a medium of exchange between feed inputs and livestock products as outputs. This study by Dr. Grimshaw was based only on feed costs and transportation costs of feed and livestock products to meet the demand for the livestock product by region.

CHAPTER III

PROCEDURE

Source of data

The data utilized in this study has been secondary data as compiled by the Department of Agriculture, National Academy of Sciences, and a few other minor sources.

The information obtained from the Department of Agriculture has to do with crop and livestock production. Some of the data obtained from these publications are: prices received by farmers for various classes of livestock, poultry, and crops; per capita consumption of livestock products; and the percent carcass weight is of average live weight for the types of livestock and poultry used in this analysis.

Nutrient requirements for the various classes of livestock were obtained from the National Academy of Sciences publications. This includes such things as the energy requirement used to produce a pound of product. This energy requirment is in Mcal ME (Mega calories of metabolizable energy). All feed, concentrates and roughage, are converted to Mcal ME for each of the livestock classes.

Other sources include the U.S. Census for population data, Texas A.&M. Transportation formula--for calculation of transportation rates, and advice from Utah State University Extension staff in interpreting the data in the most feasible way.

The model

The model is a linear program that was originally used by Dr. Paul Grimshaw in the analysis of the livestock industry in the Pacific Northwest. The program was developed and utilizes the MPS-360 Packet. A few modifications to the program enabled it to be used for consideration of the Utah livestock industry.

The cost minimization property of the model makes possible the theoretical production of livestock and poultry products on a least cost basis. This is accomplished through feeding the least cost feed combination to the respective livestock to obtain the desired gain or output of product at a minimum cost. The model is designed to insure that the ration fed to the respective livestock is a balanced ration providing minimum protein and energy requirements for each class of livestock to permit optimum gains.

The minimizing of the cost is figured in connection with weighted averages by regions for the crop and livestock products.[2] Utah is considered as one region to enable careful consideration of the competitive position of Utah's livestock industry.

Transportation costs in the model are figured from a center point in each region. These locations are as follows: Portland, Oregon, for Region I; Denver, Colorado, for Region II; Los Angeles, California, for Region III; Omaha, Nebraska, for Region IV; Chicago, Illinois, for Region

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[2]See page 10, footnote 4.

V; and Salina, Utah, for Region VI. These locations are intended to be the most feasible places from which to base the transportation charge in each of the respective regions. The transportation activities of the model allow movement of feed grains as well as livestock products from region to region.[3] Through means of transportation activities in the model, all crops or livestock products may be transported between regions if the relative price differences between regions are great enough to more than offset the transportation costs.

There are some assumptions which have to be made about the model in order to enable it to be workable.

(1) The years of 1970 and 1971 were selected as the main years for consideration. The reason for this is because of available secondary data.

(2) Feed grain production less net exports is set as an upper bound for each particular feed grain on a region by region basis. The U.S. production of any feed grain would then be the upper bound for the whole model, because import or export of feed grains is only between the regions designated in the model and this only includes the 48 states.

(3) Alfalfa hay is an exception to reason #2 and it is only fed to beef and milk cows in the model. The feeding of hay to beef is also limited to 300 pounds of each 2,000 pounds of feed fed to beef. This is done in order to enable the rate of gain assumed in the model to be

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[3]Transportation of livestock products is figured on a carcass weight equivalent.

realistic. The rate of gain varies between 2.64 and 2.86 pounds of gain daily for fed beef. Alfalfa hay fed to dairy cows is fed on a basis of 5 tons per cow yearly. It is assumed that alfalfa hay does not move between regions.

(4) Transportation costs for the model were chiefly obtained from a survey conducted by Texas A&M University. The transportation costs of livestock and poultry, which includes beef, pork, broilers and turkeys are calculated on a carcass weight or ready-to-cook basis respectively. These costs are then converted to live weight equivalents for model use, because in the model we use live weight in production and consumption as opposed to carcass weight.

(5) When the ration fed to produce a certain livestock product did not meet the minimum protein requirement, 44 percent soybean meal was used to meet this requirement. Here the average price paid by farmers was used so no transportation cost is necessary. The use of 44 percent soybean meal for a protein supplement was done to help simplify the model as much as possible.

(6) All livestock and feed grain prices are entered in the model as the weighted average price received by farmers.[4] More feed or product can be obtained for a region by transporting from one region to another

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[4]Weighted average price can be obtained by taking the production of a specified crop or livestock by state and multiplying by the price received for that commodity by state and then adding this gross income up over the region and dividing it by the total production for that region to get the weighted average price per unit per region.

where the price in the region of origin is increased by the transportation cost.

(7) Beef used in the model is fed beef and is obtained by assuming that 320 pounds per head is put on each animal classed as fed beef by concentrates. (2)* The reasons for using 320 pounds is because this gain more nearly approximates the total fed grain utilized by beef animals. This is assuming about 8.1 pounds of feed is necessary to obtain 1 pound of gain.

(8) The quantity of each livestock product demanded is determined by consumption of that product in each state and then summing over the states of the region to determine the demand per region. This goes into the model as a fixed number on a region basis.

(9) The cost of producing a unit of livestock product is the cost of the feed required to produce that unit of product. The feed used can be produced on a local basis or transported in where a transportation charge is added to the original price of the feed. The product will be produced by the least cost method of production.

(10) The conversion of feed to livestock products was accomplished through a medium of metabolizable energy. (3)** In all cases, a least

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*Seventy-two percent of all cattle slaughtered are fed beef. Source: Bob Reierson, Western Livestock Round-up, Denver, Colorado.

**The energy used is Mega Calories of metabolizable energy which is the food intake gross energy minus fecal energy, minus energy in the gaseous products of digestion, minus urinary energy. Source: Biological Energy Interrelationships and Glossary of Energy Terms.

square regression line was fitted to the ranges that were of concern in the analysis. The R^2 terms were extremely good which indicated that the relationships are linear for the suitable ranges. (See development of the data.)

(11) All the feed grains produced except wheat are assumed available for livestock feeding.[5]

The model can best be illustrated by showing that it is an optimization problem (minimize costs) with four constraints. The objective function can be represented by:

$$"\sum_{j}\sum_{i}\sum_{k} C_{jik} R_{jik} + \sum_{j}\sum_{kg} Y_{j(kg)} S_{j(kg)} + \sum_{i}\sum_{kg} Z_{i(kg)} T_{i(kg)}$$

where the objective function is the cost function that is going to be minimized.

C_{jik}: The per unit cost of feeding the jth feed grain to the ith class of livestock in Region k.

R_{jik}: The number of units (quantity) of the jth feed grain fed to the ith class of livestock in Region k." (4)*

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[5]Wheat available for livestock feeding per region was figured on a percent basis of total wheat produced per region. Region I--25 percent, Region II--10 percent, Region III--100 percent, Region IV--10 percent, Region V--25 percent, Region VI--10 percent.

*Taken from Dr. Grimshaw's disertation on Economic Consideration for Expanded Feeding of Livestock in the Pacific Northwest.

Therefore, $\sum_j \sum_i \sum_k C_{jik} R_{jik}$ is a representation of the total cost of feed to produce all livestock required for consumption over all the regions of production.

"$Y_{j(kg)}$: The unit cost of transporting the jth feed grain from Region k to g where k is the region of origin and g is the region of destination.

$S_{j(kg)}$: Quantity of the jth feed grain transported between Region k and Region g where k is the region of origin and g is the region of destination."*

As explained, $\sum_j \sum_{kg} Y_{j(kg)} S_{j(kg)}$ is the transportation cost of moving any feed grain from one region to any other region summed over the entire six regions.

"$Z_{i(kg)}$: The unit cost of transporting the ith livestock product from Region k to g where Region k is the region of origin and g is the region of destination.

$T_{i(kg)}$: Quantity of the ith livestock product transported between Region k and g where k is the region of origin and g is the region of destination."**

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*See source footnote (4) page 12.

**See source footnote (4) page 12.

This makes the following expression: $\sum_{i}\sum_{kg} Z_{i(kg)}\ T_{i(kg)}$, the transportation cost of moving any livestock product from one region to any other region summed over the entire six regions.

The overall objective function which is:

$$\sum_{i}\sum_{j}\sum_{k} C_{jik}\ R_{jik} + \sum_{j}\sum_{kg} Y_{j(kg)}\ S_{j(kg)} + \sum_{k}\sum_{kg} Z_{i(kg)}\ T_{i(kg)}$$

can best be explained as the total cost of producing the total quantity of livestock products demanded. This is done on a cost minimizing basis where both the livestock products and feed grains can be transported from region to region by means of a transportation cost.

The constraints in the model are four in number.

"(1) $R_{jk} \leq A_{jk} + \sum_{gk} S_{j(gk)} - \sum_{kg} S_{jkg}$.

(2) $D_{ik} = L_{ik} + \sum_{gk} T_{igk} - \sum_{kg} T_{ikg}$.

(3) $\sum_{j} E_{jik}\ R_{jk} \geq F_{ik}\ L_{ik}$ for all i and k.

(4) $\sum_{j} N_{jik}\ R_{jk} \geq M_{ik}\ L_{ik}$ for all i and k.

R_{jk}: Quantity of the jth feed grain available for feeding in the kth region.

A_{jk}: Quantity of the jth feed grain produced for feeding in the kth region.

$S_{j(kg)}$: Quantity of the jth feed grain transported between Region k and Region g where k is the region of origin and g is the region of destination.

D_{ik}: Quantity of the ith livestock product demanded (consumed) in the kth region.

L_{ik}: Quantity of the ith livestock product produced in the kth region.

$T_{i(kg)}$: Quantity of the ith livestock product transported between region k and g where k is the region of origin and g is the region of destination.

E_{jik}: The metabolizable energy supplied per unit of the jth feed grain when fed to the ith class of livestock in the kth region.

F_{ik}: The metabolizable energy required per unit of product produced by the ith class of livestock in the kth region.

N_{jik}: The digestible protein supplied per unit of the jth feed grain when fed to the ith class of livestock in the kth region.

M_{ik}: The protein required per unit of product produced by the ith class of livestock in the kth region."*

The no. 1 constraint $R_{jk} \leq A_{jk} + \sum_{gk} S_{j(gk)} - \sum_{kg} S_{j(kg)}$ says that the quantity of the jth feed grain in the kth region has to be less than or equal to the amount of the jth feed grain produced in Region k minus net exports of the jth feed grain from Region k.

*See source footnote (4) page 12.

The no. 2 constraint $D_{ik} = L_{ik} + \sum_{gk} T_{i(gk)} - \sum_{kg} T_{i(kg)}$ makes the quantity of the ith livestock consumed in Region k equal the amount of the ith livestock produced in Region k minus net exports of the ith livestock from Region k.

The no. 3 constraint $\sum_{j} E_{jik} \; R_{jk} \geq F_{ik} \; L_{ik}$ for all i and k says that the total amount of metabolizable energy supplied when all of the jth feeds are fed to a ith class of livestock for a particular Region k has to be greater than or equal to the amount of metabolizable energy required to produce the amount of the ith livestock product produced in the kth region.

The no. 4 constraint $\sum_{j} N_{jik} \; R_{jk} \geq M_{ik} \; L_{ik}$ for all i and k insures that the digestible protein supplied by all the jth feed grains when fed to a ith class of livestock for a particular region k is greater than or equal to the minimum protein requirement to produce the amount of the ith livestock product produced in the kth region.

In the model the values of j, i, and k are as follows:

j = 1, 2, ..., 7 where the values of j represent the following feeds:

1 - barley

2 - wheat

3 - corn

4 - oats

5 - milo (grain sorghum)

6 - alfalfa hay

7 - protein supplement (44 percent soybean meal)

$i = 1, 2, \ldots, 6$ where the values of i represent the following livestock products:

1 - fed beef

2 - pork

3 - broilers

4 - turkeys

5 - eggs

6 - milk

$k = 1, 2, \ldots, 6$ where the values of k represent the following feed-producing, livestock-product producing and consuming regions:

1 - Region I (Portland)

2 - Region II (Denver)

3 - Region III (Los Angeles)

4 - Region IV (Omaha)

5 - Region V (Chicago)

6 - Region VI (Salina)

Development of the data

The purpose of the model is to minimize the objective function subject to the constraints as previously mentioned. This was accomplished by a linear program which was designed previously for study of the Pacific Northwest. The United States was divided into six regions as follows: Region I is Oregon and Washington; Region II is comprised of Montana, Idaho, Wyoming, Colorado, Nevada, Arizona and New Mexico; Region III is comprised only of California; Region IV is comprised of North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri, Oklahoma and Texas; Region V is comprised of the New England States, Mid-Atlantic States, East North Central States, South Atlantic States, East South Central States, Arkansas and Louisiana. Region VI is comprised of Utah only to enable careful consideration of its competitive position in the livestock industry. The Regions are indicated on Figure 1.

Through the analysis, answers to the following questions should be revealed.

(1) How much of each livestock product should be produced in each respective region?

(2) Which feed grains should be fed to produce each of the products for each region?

(3) Where should feed grains come from for each region?

(4) If any product is transported, where should its origin and destination be to meet the demand of the product?

The program works on the basis that feed grains have a certain level of protein and metabolizable energy when fed to different classes of livestock as shown in Table 2. It takes a certain quantity of protein and metabolizable energy to produce a specified quantity of product. This is specified in Table 3 for the various regions. Table 3

Figure 1. Regional breakdown for the United States

Table 2. Nutrients furnished by one ton of feed in Mcal M.E. or percent D.P. when fed to various classes of livestock (5)*

Class of Livestock	Variables	Barley	Wheat	Corn	Oats	Milo	Alfalfa Hay	Protein Supplement
Beef	Mcal ME	2423	2598	2566	2219	2423	1683	2509
Beef	% D.P.	8.7	8.5	6.5	8.8	6.3	11.4	37.3
Hogs	Mcal ME	2609	3099	2971	2420	2896	----	2718
Hogs	% D.P.	8.2	9.9	7.0	9.9	7.9	----	39.4
Broilers	Mcal ME	2400	2800	3100	2300	3000	----	2200
Broilers	% D.P.	11.6	10.8	8.8	11.8	11.1	----	43.8
Turkeys	Mcal ME	2400	2800	3100	2300	3000	----	2200
Turkeys	% D.P.	11.6	10.8	8.8	11.8	11.1	----	43.8
Layers	Mcal ME	2400	2800	3100	2300	3000	----	2200
Layers	% D.P.	11.6	10.8	8.8	11.8	11.1	----	43.8
M. Cows	Mcal ME	2423	2598	2566	2219	2423	1683	2509
M. Cows	% D.P.	8.7	8.5	6.5	8.8	6.3	11.4	37.3

*Source: Calculations based on United States-Canadian Tables of Feed Consumption. Some adjustments have been made by recommendation from Oregon State University and Utah State University staff members. These adjustments were put in as revisions by Dr. Grimshaw of Utah State University Extension Service, Logan, Utah.

Table 3. Nutrient requirements per 1,000 pounds of product or per 1,000 dozen eggs produced by regions, 1970 (6)*

Regions	Variables	Beef	Pork	Broilers	Turkeys	Eggs	Milk
I	Mcal ME[6]	10,860	4,960	3,267	3,520	6,103	1,038
I	% D.P.[7]	7.1	13.0	18.0	20.1	15.0	14.0
II	Mcal ME	10,723	4,963	3,098	3,547	6,274	1,074
II	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
III	Mcal ME	10,748	4,971	3,273	3,541	6,314	970
III	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
IV	Mcal ME	10,731	4,986	3,243	3,528	6,311	1,075
IV	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
V	Mcal ME	10,800	4,973	3,239	3,533	6,613	1,076
V	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0
VI	Mcal ME	10,860	4,959	3,262	3,566	5,839	1,037
VI	% D.P.	7.1	13.0	18.0	20.1	15.0	14.0

*Source: Calculated by author based on nutrient requirement of domestic animals.

[6]Mcal ME designates mega calories of metabolizable energy.

[7]% D.P. means percent digestible protein.

was computed by the author from Nutrient Requirements of Domestic Animals.

The following results were obtained by mathematically fitting a least square regression line through the available data in the relevant range. This is for the metabolizable energy.

<u>Beef</u> $Y = 599.0537 + 2.74739X$ $R^2 = .9997$

X = Weight of beef in pounds

Y = Mcal of M.E.

<u>Hogs</u> $Y = -83.4453 + 5.323X$ $R^2 = .9788$

X = Weight of pork in pounds

Y = Mcal of M.E.

<u>Broilers</u> $Y = -1.6505 + 3.696278X$ $R^2 = .9868$

X = Weight of broiler in pounds

Y = Mcal of M.E.

<u>Turkeys</u> $Y = -4.8909 + 3.7923X$ $R^2 = .9788$

X = Weight of turkeys in pounds

Y = Mcal of M.E.

<u>Eggs</u> $Y = 28.366 + 11.151\ (X_1) + .183(X_2)$ $R^2 = .977$

X_1 = Weight of chicken in pounds

X_2 = Number of eggs per year

Y = Mcal of M.E.

Milk $$Y = -771.885 + 3.516X_1 + 639.774X_2 + .459X_3$$
$$R^2 = .998.$$

X_1 = Weight of cow in pounds

X_2 = Percent B. F.

X_3 = Milk production in pounds

Y = Mcal of M.E.

All of the $X_1 \ldots X_n$ used in each of the regression equations are based on the regional weighted average.[8]

The percent digestible protein was obtained from the United States--Canadian tables of Feed Composition.

The livestock products produced in the model are: fed beef, pork, turkey, broilers, milk and eggs.[9] The feeds available in the model are: barley, wheat, corn, oats, grain sorghum (milo), hay, and 44 percent soybean meal.[10]

The coefficients shown in Tables 2 and 3 are the means by which the model is able to produce a certain product from a certain ration on a cost minimizing basis. The basis used is Mcal of Metabolizable Energy. Each feed grain is converted to Mcal M.E. for feeding to each type of

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[8]Turkeys, for example, average live weight of turkeys was obtained per region by taking total live weight per region and dividing by number of birds per region.

[9]Fed beef in the model refers to the amount of gain put on by concentrates and a limited amount of hay.

[10]Soybean meal doesn't have an upper bound like the other feeds, its main purpose is for a protein supplement to enable minimum protein requirements for each of the respective livestock products.

livestock by using data from Table 2. Based on the amount of energy (Mcal M.E.) available using data from Table 3, the model calculates the quantity of the product produced.

To insure that the correct value is supplied for consumption, quantity demanded has been calculated in the following manner: population by state was obtained from the U.S. Census; these population figures were then multiplied by state per capita consumption indexes as publised in the National Food Situation; the product computed above is multiplied by the per capita consumption for each class of livestock. This give carcass weight consumed for each of the red meats and poultry per state. This is then converted to average live weight by a factor multiplication for each of the classes of livestock; it is converted to number of head per state by dividing the live weight totals per state by average live weight per animal per state. Total number of head is summed and compared to the total head slaughtered in the 48 states less net import. In making this comparison we were within 2 to 3 percent for each of the various classes of livestock which shows that the procedure is very reasonable. This procedure allows a breakdown of the total consumption of the livestock products on a state basis. Summing the state consumption of each livestock product for each state in the region permits determination of the state totals. These figures on consumption of livestock products are then put into the model as fixed values. These regional consumption requirements are then met as determined by the model. The model does this on a least cost basis allowing transportation of both product and feed grains if necessary with a cost of transportation being added.

CHAPTER IV

AGRICULTURE PRODUCTS IN 1970--ANALYSIS FROM MODEL

The analysis carried out in this chapter has been done by use of the model.[11] A word of caution about the economic interpretation of the data utilized from the analysis is necessary. As mentioned previously, the costs in the model only include feed and transportation costs. It is assumed that all other costs are relatively equal in the respective regions of comparison. This doesn't always hold true. The price of land from one region to another can and does differ greatly in some cases. The price of labor can have the same effect. California for example, pays much higher wages on the average than many of the surrounding states. Taxes also can have a great effect. Another important factor is economies of size. It isn't intended to mention all of these differences but the intent is to make an awareness of these other influencing factors which can and in some cases do turn the cost picture completely around. These non-feed and non-transportation costs are not included in the cost evaluation and will only be included in the analysis if specified.

Fed beef

The fed beef in the model refers only to the gain put on by con-

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[11] Linear programming model used by Grimshaw in evaluation of the Pacific Northwest.

centrates and a limited amount of hay as explained in the previous chapter. Table 4 shows the biggest concentration of beef production is centered in Region IV. Analysis of the model shows that Regions III and V should not be producing any beef. It is more economical for those two regions to import (transport from other regions) all their fed beef because of the high cost of feed in these regions. Utah, as Region VI, only produces about 67 percent of the fed beef consumed in Region VI. Region I only producers about 28 percent of the fed beef consumed in its own region. Along with Region IV, Region II is also a surplus producer of beef. Looking at Table 5 and Table 28 (See Appendix for Table 28) helps to show the reasons for the surplus or deficit production of beef per region.

Barley is the main grain fed to beef. According to the model, barley in Region III is too expensive as an input cost to produce beef economically. Instead, the most economical way of meeting the quantity of fed beef demanded is to import all the beef demanded for California (Region III) from Region IV which is centered from Omaha for transportation purposes. The price of barley in Region III would have to decrease to $47.37 per ton to be competitive with Region IV in producing the next unit of fed beef demanded in Region III. The reason being that Region IV can produce the next unit of fed beef at $194.60 per thousand pounds.[12] It can then transport the beef from Omaha (transportation center for

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[12]Live weight.

Table 4. Fed beef production and consumption by regions, 1970

	Consumption (7)*	Production[13]					
	(1,000 Pounds)[14]	(1,000 Pounds)[14]					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	345,189	97,000.19	---	---	248,188.81	---	---
Region II	461,655	---	461,655	---	---	---	---
Region III	1,271,741	---	389,006.11	---	882,734.89	---	---
Region IV	2,011,879	---	---	---	2,011,879	---	---
Region V	7,945,754	---	---	---	7,945,754	---	---
Region VI	66,913	---	22,001.98	---	---	---	44,911.02
TOTAL	12,103,131	97,000.19	872,663.09	---	11,088,556.7	---	44,911.02

*Consumption was computed by author by using U.S.D.A. publications and U.S. Census.

[13]Production was calculated by the linear programming model on a least-cost basis to meet the total quantity demanded for the six regions.

[14]Pounds in live weight or live weight equivalent.

Table 5. Utilization of feed grains and hay to produce fed beef, 1970

	Production of fed beef[15] (1,000 Pounds)	Produced by feeding the following grains and hay (Tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	97,000.19	434,759.4	---	---	---	---	---	---
Region II	872,663.09	3,006,150.42	---	668,087.37	---	---	213,518.49	---
Region III	---	---	---	---	---	---	---	---
Region IV	11,088,556.7	1,813,464.54	---	38,313,845.18	5,420,914.96	---	2,528,188	---
Region V	---	---	---	---	---	---	---	---
Region VI	44,911.02	176,472	---	---	---	---	35,735	---

[15] Table 4, footnote 13.

Region IV) to Los Angeles (transportation center for Region III) at a cost of \$15.52 per 1,000 pounds.[16] This makes the total cost of delivering 1,000 pounds of fed beef to Region III from Region IV \$210.12. This cost doesn't include non-feed costs such as differences in land, labor, and taxes of the different regions. If this same 1,000 pounds of beef were produced in Region III by feeding barley at the going price per ton in Region III of \$50.83, it would cost \$225.48 for the 1,000 pounds making an increased cost of \$15.36 per 1,000 pounds. This clearly points out that Region III was at a comparative disadvantage in trying to produce its own fed beef in 1970. Because it was unable to compete for the production of one additional unit of 1,000 pounds of fed beef with Region IV, it certainly can't compete for the previous units produced. The cost of producing fed beef in Region IV will increase as the amount produced in Region IV increases. The reason for this is because other feeds that cost more relative to production will have to be used as the amount of fed beef produced increases. If this cost of producing fed beef arises high enough in Region IV, then it would be to the overall economic advantage to produce some of this fed beef elsewhere.

Utah's consumption of fed beef is two thirds from production inside Utah and one third of it comes from Region II (based from Denver for transportation). The cost of transporting fed beef from Denver to Salina

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[16] The 1,000 pounds is the live weight equivalent of 583 pounds of carcass weight which is the actual amount being shipped. Live weight equivalent is in the model only for working convenience.

is $8.02 per 1,000 pounds. Feed costs for producing the next 1,000 pounds of fed beef in Region II are $197.96. This means that the next unit of fed beef produced in Region II and transported from Denver to Salina would be at a cost of $205.98. Utah was in a competitive position with Region II for the 67 percent of the fed beef Utah produced for consumption in Utah (Region VI). In Utah fed beef was produced at a cost of $195.06 per 1,000 pounds before the barley supply and 35,735 tons of hay were completely utilized. At this time, another source of feed had to be used or fed beef had to be imported into the State to meet the consumers' demands for fed beef. The least cost method was to transport from Denver the remaining 22 million pounds of fed beef rather than produce it on a local level.

An important factor has been deleted in considering the least cost method of meeting Utah's consumer demand for fed beef. Each year Region VI exports around 245,000 feeder cattle. (8)* This puts Utah in a much better competitive position than the previous analysis would indicate to supply all of the fed beef for consumption in Utah. Utah already has the feeder cattle, where some of its competitors such as Region II have to import many of their feeder cattle. When importing feeder cattle, a region has to pay the price of the feeder cattle in the region of origin plus the transportation cost. The transportation cost of feeder cattle depends upon the size of the animal and the distance transported. Utah's

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*Source: Feasibility of Expanding the Livestock Feeding and Meat Packing Industry in Utah. Taylor et. al. Page 28.

main destinations when exporting feeder cattle are Colorado, Arizona, California, and even as far as Indiana. The average weight of these feeder cattle would be close to 500 pounds.

Since Region VI's main competition in supplying fed beef to Region VI is Region II, it would be worthwhile to consider the cost factor of feeder cattle between these regions. First the feeder cattle will be transported from Region VI to Region II at a cost of $4.65 a head. (9)* The fed beef is then transported back to Utah for consumption. The total cost for the transportation of the feeder cattle out of Utah and the fed beef back to Utah from Denver is $22.73 per 1,000 pounds. On the other hand, grain could be transported into Utah to produce fed beef on a local basis. The cost of transporting grain from Region II to Region VI is $4.97 per ton. If barley was transported from Region II to produce fed beef in Utah, it would cost $22.05 for the transportation of barley to produce the 1,000 pounds of fed beef in Utah. This would give Utah a $.50 advantage for producing 1,000 pounds of fed beef. Of course, this is only a small advantage, but it points out that Utah is in a competitive position to produce all of its fed beef instead of one third of it being imported from Region II.

Pork

Pork production in 1970 was centered in Region IV. The Region

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*Livestock Marketing Handbook, Extension Services, Utah State University, Logan, Utah.

produced about 11 million pounds of pork. Region V was a close second with 9 million pounds of pork. The model suggests a few changes when considering only the feed and transportation costs. As indicated by Table 6, Region V should be producing 14.6 million pounds of pork. Region IV should only be producing 4.2 million pounds. The model suggests that all of the pork for Region V should be produced in the region while all of its beef should be imported in 1970.[17]

California (Region III) is in much the same position as Region V when comparing pork production to beef production. The model indicated 502 thousand pounds of pork should be produced in Region III, but only 49 thousand pounds were actually produced on a local level. This indicates that California should raise more pork in the region and import beef if costs are to be minimized.

Utah's pork production in the real world is far below its potential output. The analysis suggests that Utah should produce all of the pork consumed in 1970, in actuality Utahn's only produced 17 percent (16,488,000 pounds live weight). Utah, unlike California and Region V, didn't have to sacrifice any of its beef production in 1970 in order to produce more pork economically. Utah producers have a difficult time getting a good price for their product. The price of pork in Utah usually falls below the Omaha price of pork. It should not be this way because of our deficit

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[17]Some fed beef could be produced on a local level by feeding wheat. This would be at a lower cost than importing fed beef from Region IV, but this would increase the total cost for overall production of all the livestock products.

Table 6. Pork production and consumption by regions, 1970

	Consumption* (1,000 Pounds)[19]	Production[18] (1,000 Pounds)[19] Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	500,846	500,846	---	---	---	---	---
Region II	657,746	---	657,746	---	---	---	---
Region III	1,816,978	175,965.35	8,247.49	501,962.26	1,130,802.9	---	---
Region IV	3,093,908	---	---	---	3,093,908	---	---
Region V	14,626,969	---	---	---	---	14,626,969	---
Region VI	96,435	---	---	---	---	---	96,435
TOTAL	20,792,882	676,811.35	665,993.49	501,962.26	4,224,710.9	14,626,969	96,435

*See source footnote (7), page 28.

[18]See Table 4, footnote 13.

[19]See Table 4, footnote 14.

production of pork for consumption in the State of Utah. The price that farmers receive in the State of Utah should be the price of pork in Omaha plus the transportation cost of bringing it to Utah. There are at least two reasons why the price farmers receive for pork in Utah is not a competitive price.

(1) Few slaughter plants killing a small volume result in relatively high kill costs.

(2) Many sellers and few buyers result in reduced competition.

(3) Quality pork not produced in Utah in the past.

Slaughter plants and volume. At the present time there are only two major plants which slaughter hogs in the State of Utah. Tri Miller being the largest pork killing plant is mainly set up to slaughter beef. The other slaughter plant is Ogden Dressed Meats which isn't nearly large enough to operate on an efficient scale. The efficiency with which pork is slaughtered and distributed to the consumer for buying does effect the price farmers receive for their pork. Volume is an important factor of cost in a slaughter plant. Ogden Dressed Meats only slaughters 80 pigs per day. Tri Miller slaughters approximately 172 pigs per day.

Multiplicity of sellers and few buyers. A multiplicity of sellers and only a few buyers enables a market such as Utah to be a buyer's market rather than a seller's market. The producers of pork in the State of Utah are large in number relative to the number of hogs produced. They sell many of their hogs through the local auction a few at a time. The producers have no bargaining power when selling their hogs in this manner. The average size farm produced only 25 pigs in the State of Utah in 1969, if all farms producing hogs are counted. (10)* Hog producers with an income over $2,500 annually had an average production of 32 pigs per farm in 1969.**

Table 7 indicates the feeds that should be fed to produce pork in 1970.

Broilers

Table 8 shows that all regions should be self sufficient in meeting the quantity of broilers demanded per region in 1970. Broilers were produced according to the analysis, by feeding the feed grains, on a region basis as indicated in Table 9.

Table 9 also shows that the protein supplement (44 percent soybean meal) has to be fed in all regions to have a ration that contains 18 percent digestible protein. Regions, I, II, III, and IV produced all of their feed grains for the production of broilers on a local level. Region V used corn produced in the region plus milo transported from Region IV along with protein supplement to produce the broilers in Region V. Region V would have a cost of $76.589 per 1,000 pounds for producing one more thousand pound unit of broilers. Region V had an excess of corn that wasn't utilized. If Region V would have fed this

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*1969 Census of Agriculture, Utah.

**Ibid.

Table 7. Utilization of feed grains to produce pork, 1970

	Production of Pork[20] (1,000 Pounds)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	676,811.35	---	982,103	---	---	---	115,322.7
Region II	665,993.49	---	537,373.94	---	536,112	---	126,053.27
Region III	501,962.26	---	665,250	---	80,800	---	87,604.36
Region IV	4,224,710.9	---	2,389,317	879,073.16	3,556,781.04	---	898,005.41
Region V	14,626,969	---	1,523,580	18,817,835.09	---	---	4,455,685.93
Region VI	96,435	---	139,906.06	---	---	---	16,428.36

[20] Table 4, footnote 13.

Table 8. Broiler production and consumption by regions, 1970

	Consumption* (1,000 Pounds)[22]	Production[21] (1,000 Pounds)[22]					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	308,986	308,986	---	---	---	---	---
Region II	405,784	---	405,784	---	---	---	---
Region III	1,120,943	---	---	1,120,943	---	---	---
Region IV	1,633,142	---	---	---	1,633,142	---	---
Region V	8,113,768	---	---	---	---	8,113,768	---
Region VI	59,493	---	---	---	---	---	59,493
TOTAL	11,642,116	308,986	405,784	1,120,943	1,633,142	8,113,768	59,493

*See source footnote (7), page 28.

[21]Table 4, footnote 13.

[22]Table 4, footnote 14.

Table 9. Utilization of feed grains to produce broilers, 1970

	Production of broilers[23] (1,000 Pounds)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	308,986	223,803.08	---	90,151.3	---	---	87,664.02
Region II	405,784	---	---	318,833.68	---	5,186.37	115,079.68
Region III	1,120,943	---	---	429,584.56	---	557,391.16	302,254.92
Region IV	1,633,142	---	---	---	---	1,475,956.05	394,732.43
Region V	8,113,768	---	---	338,921.12	---	6,956,903.05	1,981,422.69
Region VI	59,493	---	---	---	---	54,081.95	14,463.78

[23]Table 4, footnote 13.

unused corn along with protein supplement to produce broilers instead of transporting milo in from Region IV, it would have cost $76.589 per 1,000 pounds for every 1,000 pounds of broiler produced in Region V. The least cost way to produce broilers in Region V was to bring in the milo from Region IV. This was done until the supply of milo was utilized and then corn was the next best alternative. Using milo, imported from Region IV, and protein supplement broilers could be produced in Region V at a cost of $69.260 per 1,000 pounds. This is $7.329 per 1,000 pounds cheaper than using corn already available in Region V. There was 7,707,324 pounds of broilers produced in Region V by feeding milo imported from Region IV, along with protein supplement. If this first 7,707,324 pounds of broiler in Region V was produced with corn from Region V instead of milo, it would have cost an additional $56,486,978 in feed costs. The remaining 406,444 pounds were produced at $76.589 per 1,000 pounds by feeding corn already available in Region V.

Utah produced all of the broilers consumed by importing milo from Region II according to the model. Utah's price for milo was $48.50 per ton. This cost resulted from a $43.53 per ton cost for milo produced in Region II plus $4.97 per ton for transporting the milo from Region II to Region VI.

To produce broilers by meeting the minimum protein requirement, a ration of 21.1 percent protein and 78.9 percent milo had to be fed. To produce 1,000 pounds of broilers by feeding the previously mentioned ration would require 1.1521 tons of the ration in Utah.[24] This would mean feeding 483 pounds of protein (44 percent soybean meal) to each 1,805 pounds of milo to produce the 1,000 pounds of broilers. The cost of the protein was $127.50 per ton. The price of milo as previously indicated was $48.50 per ton. The average cost of producing 1,000 pounds of broiler in Region VI was $75.09.

Turkey

Turkey is similar to broilers in that all turkeys should be grown in the region in which it is consumed (see Table 10). Table 11 shows that the main feed grain that should be fed to turkeys is corn with the exception of milo in Region IV. A protein supplement is required in every region in order for the rations to have a 20.1 percent digestible protein level. All regions produced all their feed grains to feed turkeys on a local level with the exception of Utah. Utah has transported corn from Region II to produce turkeys in their region.

There is a difference in the cost of producing turkey from region to region, but the transportation cost is high enough to prohibit movement of turkey from one region to another. A comparison of Region I and Region II can be made. The cost of transporting frozen turkey from Region II to Region I is $17.951 per 1,000 pounds of live weight equivalent. This transportation cost plus the cost of production in Region II

[24] Varies from region to region because of live weight of broiler at slaughter time.

Table 10. Turkey production and consumption by regions, 1970

	Consumption* (1,000 Pounds)[26]	Production[25] (1,000 Pounds)[26] Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	52,683	52,683	---	---	---	---	---
Region II	69,186	---	69,186	---	---	---	---
Region III	191,125	---	---	191,125	---	---	---
Region IV	278,458	---	---	---	278,458	---	---
Region V	1,391,321	---	---	---	---	1,391,321	---
Region VI	10,144	---	---	---	---	---	10,144
TOTAL	1,992,917	52,683	69,186	191,125	278,458	1,391,321	10,144

*See source footnote (7), page 28.

[25]Table 4, footnote 13.

[26]Table 4, footnote 14.

Table 11. Utilization of feed grains to produce turkeys, 1970

	Production of Turkey[27] (1,000 Pounds--Live Weight)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	52,683	---	---	44,696.7	---	---	21,311.09
Region II	69,186	---	---	59,148.23	---	---	28,201.47
Region III	191,125	---	---	163,119.44	---	---	77,774.25
Region IV	278,458	---	---	---	---	256,137.25	97,267.31
Region V	1,391,321	---	---	1,184,767.92	---	---	564,889.34
Region VI	10,144	---	---	8,718.72	---	---	4,157.03

[27] Table 4, footnote 13.

would make the cost of turkey from Region II to Region I total $107.918 per 1,000 pounds (live weight equivalent). This would increase the cost of turkey in Region I by $7.13 per 1,000 pounds. Region I has a $7.13 per 1,000 pounds advantage over Region II in supplying turkey required for consumption in the region.

It is also well to remember that many of the feeds used to produce turkey were used for broilers and eggs because of the relative over all cost advantage it offered to the whole economy. Suppose milo was used in Region II to produce turkeys instead of corn. A ration of 27.52 percent protein to 72.48 percent milo would have to be fed. By feeding this ration, turkey could be produced in Region II at $82.87 per 1,000 pounds. To produce 1,000 pounds of turkey 1.276 tons of the above ration would have to be fed. This is $6.97 per 1,000 pounds cheaper than using corn to produce turkeys. The important thing here is that it is relatively less expensive to produce broilers and eggs in Region II with milo and produce the turkey with corn as opposed to producing turkeys with milo and broilers and eggs with corn. Region IV can produce turkey with either milo or corn and not influence its production of other products. The price of corn relative to milo is high for producing turkeys in Region IV. Therefore, turkeys are produced by use of milo and protein supplement instead of corn and protein supplement.

According to the model, Utah should be producing 10,144,000 pounds of turkey. This amount would meet the quantity demanded in Utah. However, in 1970 Utah producers produced over 85 million pounds of turkey. There are a number of reasons why Utah producers were able to do this. Utah turkey producers are well organized and their operation has a lot of expertise in it. A large share of Utah's turkeys are grown around Moroni and in connection with the Moroni Feed Cooperative. This turkey operation is almost completely vertically integrated. A number of characteristics of their cooperative are:

(1) They have their own feed plant which can buy grain in large quantities. All grains are milled at their own feed plant.

(2) They have their own turkey hatchery.

(3) They have their own slaughter plant and storage facilities through which they process over 2 million turkeys annually.

(4) They are affiliated with Norbest Turkey Cooperative to market their turkey.

Eggs

Egg production, according to Table 12, should be accomplished locally with the exception of California. According to the model, all eggs were produced by feeding milo and protein supplement in Regions II, III, IV, V, and VI; oats and protein supplement in Region I (Table 13).

Chickens require a minimum of 15 percent digestible protein in their ration. By feeding a ration of 11.93 percent protein to 88.07 percent milo, the basic protein requirement of 15 percent digestible protein can be achieved. Also the 15 percent digestible protein level can be achieved by feeding 10 percent protein supplement to 90 percent oats.

Table 12. Egg production and consumption by region, 1970

	Consumption*	Production[28]					
	(1,000 Dozen)	(1,000 Dozen)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	145,292	145,292	---	---	---	---	---
Region II	190,808	---	190,808	---	---	---	---
Region III	527,092	---	---	137,432.78	---	---	389,659.22
Region IV	794,613	---	---	---	794,613	---	---
Region V	3,653,293	---	---	---	---	3,653,293	---
Region VI	27,976	---	---	---	---	---	27,976
TOTAL	5,339,074	145,292	190,808	137,432.78	794,613	3,653,293	417,635.22

*See source footnote (7), page 28.

[28]Table 4, footnote 13.

Table 13. Utilization of feed grains to produce eggs, 1970

	Production of Eggs[29] (1,000 Dozen)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	145,292	109,636.28	---	---	233,888	---	38,930.73
Region II	190,808	---	---	---	---	362,995.65	49,155.66
Region III	137,432.78	---	---	---	---	263,120.84	35,630.95
Region IV	794,613	---	---	---	---	1,520,597.14	205,914.20
Region V	3,653,293	---	---	---	---	7,325,602.51	992,008.67
Region VI	417,635.22	---	---	---	---	739,428.03	100,130.88

[29]Table 4, footnote 13.

The former being fed in Regions II, III, IV, V, and VI and the latter fed in Region I.

The model prediction about the quantity of eggs produced is relatively close to the actual production in Regions I and V. The greatest variation would be in Region III and Region VI. (11)* Some variation from the real world occurs because of the transportation costs of feed grains in the model as compared to those that exist in the real world situation. Because California is such a big importer of grain, they can import grain cheaper per mile than Utah can, but the model transports grain on a per mile basis according to the Texas A&M formula. (12)**

If it was assumed that milo was shipped to California to produce eggs on a local level, eggs could have been produced for $139.35 per 1,000 dozen. Instead they were shipped from Utah for a cost of $116.9410 per 1,000 dozen plus $20.30 per 1,000 dozen for transportation. This makes a total cost of $137.24 per 1,000 dozen. The difference being only $2.11 per 1,000 dozen. This difference could easily be erased by the fact that California receives its grain for a lower transportation cost than used in the model. The main point here is that there is little comparative

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*The actual amounts produced per region in 1970 are: Region I--130,917,000 dozen. Region V--3,781,666,000 dozen. Region III--694,250,000 dozen. Region VI--21,250,000 dozen.

**Developed at Texas A&M University
$Y = .09063 + .00049X$
X = Milage
Y = Transportation cost in dollars per hundred weight.

advantage for Utah to produce California's eggs. Also it would seem clear that Utah should have a comparative advantage to produce all of its own eggs.

Milk

As Table 14 points out, all milk should be produced in the region of consumption. Table 15 shows the various feeds fed in each region to produce the quantity of milk consumed in that region. The main feeds fed to produce milk are hay, barley, and protein supplement. Protein supplement will only be used to balance the ration. A cow requires 14 percent digestible protein and if this is not met, a cow will not produce properly. If the ration is deficient in protein, then a protein supplement should be fed. Feeding mostly barley and very little hay can cause poor production to occur. Barley fed to milk cows provides 8.7 percent digestible protein which is not sufficient on its own to meet the minimum protein requirement. The thing that has to be looked at is what is the best ration according to cost in a certain area. By feeding this ration a producer will be in his best competitive position to supply milk in his own area and other areas.

Looking at the ration fed in Region I, one ton of feed would contain 6.79 percent barley, 86.47 percent hay, and 6.74 percent protein supplement. In 100 pounds of this ration barley would contribute .6 pounds of digestible protein; hay would contribute 10.9 pounds; and protein supplement would contribute 2.5 pounds of digestible protein. This adds up to

Table 14. Milk production and consumption by regions, 1970

	Consumption* (1,000 Pounds)	Production[30] (1,000 Pounds) Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	3,183,675	3,183,675	---	---	---	---	---
Region II	4,181,034	---	4,181,034	---	---	---	---
Region III	11,549,794	---	---	11,549,794	---	---	---
Region IV	17,411,808	---	---	---	17,411,808	---	---
Region V	80,052,061	---	---	---	---	80,052,061	---
Region VI	613,002	---	---	---	---	---	613,002
TOTAL	116,991,374	3,183,675	4,181,034	11,549,794	17,411,808	80,052,061	613,002

*See source footnote (7), page 28.

[30]Table 4, footnote 13.

Table 15. Utilization of feed grains and hay to produce milk, 1970

	Production of milk[31] (1,000 Pounds)	Produced by feeding the following grains and hay (Tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	3,183,675	125,393.23	---	---	---	---	1,597,412	124,504.76
Region II	4,181,034	221,609.58	---	---	---	---	2,349,061.51	---
Region III	11,549,794	1,163,443.35	---	---	---	---	4,363,846	414,477.53
Region IV	17,411,808	---	---	---	---	---	9,535,373.99	1,064,033.15
Region V	80,052,061	2,256,767.46	---	---	---	---	40,438,582	5,025,801.75
Region VI	613,002	---	---	---	---	---	377,708.3	---

[31]Table 4, footnote 13.

14 pounds of digestible protein per 100 pounds of the above mentioned ration, which meets the minimum protein requirement. By feeding a ration of this type, 1,000 pounds of milk was produced for a cost of $19.50.

All of the regions produced milk by using feeds grown in their own region, with the exception of Region V importing barley from Region IV.

California's feed ingredient costs for producing 1,000 pounds of milk would be $25.22. Utah could produce another 1,000 pounds of milk for a cost of $15.40. The transportation cost of milk from Salina, Utah, to Los Angeles, California, is $11.50 per 1,000 pounds. If milk was produced in Utah and shipped to California, the California cost would be $26.90 per 1,000 pounds. This gives California a slight comparative advantage in supplying their own milk. However, there are a number of other considerations that should be mentioned. Products such as cheese could be very competitive on the California market when imported from Utah because of the big reduction in transportation costs when compared to fluid milk. Also non-feed costs in California such as land, labor, and taxes are higher than in Utah. These factors would certainly tend to give the Utah producer a larger margin and lower costs when compared to the California milk producer.

Region II can produce another 1,000 pounds of milk for a cost of $19.83. This cost is only $3.43 per 1,000 pounds greater than for the Utah producer to produce another 1,000 pounds of milk. The difference between Region II and Region VI is very small. This would make it accurate to say that each region has a comparative advantage in its ability to supply the quantity of fluid milk consumed in its own region.

One of Utah's main advantages in being able to supply milk at a lower cost than some of the other regions is because of the high quality alfalfa hay available for use. No protein supplement is necessary to have a balanced ration and this cuts the cost of the ration down considerably.

Utah's main market for milk outside Utah would have to be California in the form of cheese and other milk products but not as fluid milk.

CHAPTER V

LIVESTOCK PRODUCT PRODUCTION, UNDER MODEL, USING 1971 PRODUCTION LEVELS AND PRICES OF FEED GRAINS AND HAY

In this section the quantity of each livestock product demanded per region is the quantity calculated for 1970. The 1970 quantities were used because of data availability; however, the quantity of each grain produced and the regional average price for the year 1971 have been put into the model. They have been incorporated to see what changes will take place for the varying prices and production levels of grain and hay.

Fed beef

Table 16 describes the production of fed beef region by region to meet the quantity demanded.

Table 17 shows the grain and hay utilized to produce the fed beef per region.

Analysis of data for the 1971 year shows that all of the fed beef produced should be produced in Region IV with the exception of Region V producing part of its own fed beef.

The main reason for the changes in location of production of the fed beef from 1970 to 1971 is the relative prices of the feed grains from region to region. Barley price increased in Regions II, III, V, and VI from 1970-1971. This increase varied from $2.00 to $5.00 per ton among

Table 16. 1971 Prices--Fed beef production and consumption[32]

	Consumption* (1,000 Pounds)[34]	Production[33] (1,000 Pounds)[34]					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	345,189	---	---	---	345,189	---	---
Region II	461,655	---	---	---	461,655	---	---
Region III	1,271,741	---	---	---	1,271,741	---	---
Region IV	2,011,879	---	---	---	2,011,879	---	---
Region V	7,945,754	---	---	---	5,330,540.16	2,615,213.84	---
Region VI	66,913	---	---	---	66,913	---	---
TOTAL	12,103,131	---	---	---	9,487,917.16	2,615,213.84	---

*See source footnote (7), page 28.

[32]Used 1971 Prices and Production on Feed Grains and 1970 Values for Quantity of Livestock Product demanded.

[33]Table 4, footnote 13.

[34]Table 4, footnote 14.

Table 17. 1971 Prices--Utilization of feed grains and hay to produce fed beef

	Production of Fed Beef[35] (1,000 Pounds)	Produced by feeding the following grains and hay (Tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	---	---	---	---	---	---	---	---
Region II	---	---	---	---	---	---	---	---
Region III	---	---	---	---	---	---	---	---
Region IV	9,487,917.16	4,390,392	---	32,955,365.58	1,045,109.62	---	2,551,606	---
Region V	2,615,213.84	---	---	10,084,238.17	---	---	1,407,103	---
Region VI	---	---	---	---	---	---	---	---

[35]Table 4, footnote 13.

the regions. On the other hand, Region IV had a 1971 price decrease of $1.50 per ton from the year earlier.

Corn was the other main feed grain used to produce fed beef. The price of corn decreased in all of the regions from 1970 to 1971. The decrease in price was greatest in Region V where a decrease of $12.18 per ton occurred. This is the main reason Region V started to produce fed beef in 1971 where it didn't produce any fed beef in 1970. In Region IV the price of corn went from $46.15 per ton to $37.71 per ton from 1970 to 1971. This decrease amounted to $8.44 per ton which put them in a better competitive position to produce even more fed beef in 1971 than in 1970. The price of corn only decreased $4.38 per ton in 1971 in Region II. This price, however, wasn't low enough relative to other prices of grain in other regions for it to be used to produce fed beef in Region II.

According to the model, Utah producers were not competitive in beef production in 1971. All of the State's beef supply was produced by Region IV and shipped to Region VI.

Pork

The level of pork production in each region comparing 1970 and 1971 changed somewhat because of the prices of grain changing from region to region. Region IV increased its production from 4,224 million pounds to 5,120 million pounds (Table 18). Region III should not have produced any pork in 1971 according to the model. The main reason for this is that in Region III wheat went from $47.33 per ton in 1970 to $54.33 per ton in

Table 18. 1971 Prices--Pork production and consumption[36]

	Consumption*	Production[37]					
	(1,000 Pounds)[38]	(1,000 Pounds)[38]					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	500,846	500,846	---	---	---	---	---
Region II	657,746	---	531,681.11	---	126,064.89	---	---
Region III	1,816,978	---	---	---	1,816,978	---	---
Region IV	3,093,908	---	---	---	3,093,908	---	---
Region V	14,626,969	---	---	---	---	14,626,969	---
Region VI	96,435	---	---	---	83,453.03	---	12,981.97
TOTAL	20,792,882	500,846	531,681.11	---	5,120,403.92	14,626,969	12,981.97

*See source footnote (7), page 28.

[36]Table 16, footnote 32.

[37]Table 4, footnote 13.

[38]Table 4, footnote 14.

1971 and oats went from $48.75 in 1970 to $54.38 in 1971. (Table 19 indicates the grains being fed to produce pork.) Region III's main competitor to supply pork to California is Region IV. The price of wheat in Region IV went down $.50 per ton from 1970 to 1971. Because of the big increase in the feed costs in Region III, Region IV could now be very competitive in supplying pork to Region III not only by feeding wheat but also by feeding milo.

Utah's production decreased from 96 million pounds in 1970 to 13 million in 1971 according to the model. The reason for such a drop in production is because of the lack of available grain, mainly wheat. In 1970 wheat was shipped into Utah from Region II to produce pork in Utah. Oats used to produce part of the pork for Region II in 1970, was priced too high to permit its utilization as a feed in pork production in 1971. As a result, Region II used all of its local wheat to produce pork for Region II. This resulted in no wheat which could be exported to Utah. Utah then could only produce pork on a local level with the wheat available in Utah. After the local supply of 1971 wheat in Utah was used for pork production, the balance of the supply was imported from Region IV.

Broilers

In 1970 all broilers were produced in the region of consumption according to the model. In 1971 the broilers for Region I and part of them for Region III were produced in Region IV (Table 20). The reason for this was because of the increased production of milo which resulted

Table 19. 1971 Prices--Utilization of feed grains to produce pork

	Production of Pork[39] (1,000 Pounds)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	500,846	---	726,764.35	---	---	---	85,339.75
Region II	531,681.11	---	771,975	---	---	---	90,648.58
Region III	---	---	---	---	---	---	---
Region IV	5,120,403.92	---	2,902,938	---	---	4,562,209.57	1,222,211.23
Region V	14,626,969	---	1,761,608	18,591,120.3	---	---	4,432,110.10
Region VI	12,981.97	---	18,834	---	---	---	2,211.57

[39]Table 4, footnote 13.

Table 20. 1971 Prices--Broiler production and consumption[40]

	Consumption* (1,000 Pounds)[42]	Production[41] (1,000 Pounds)[42] Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	308,986	---	---	---	308,986	---	---
Region II	405,784	---	405,784	---	---	---	---
Region III	1,120,943	---	---	113,861.31	1,007,081.69	---	---
Region IV	1,633,142	---	---	---	1,633,142	---	---
Region V	8,113,768	---	---	---	---	8,113,768	---
Region VI	59,493	---	---	---	---	---	59,493
TOTAL	11,642,116	---	405,784	113,861.31	2,949,209.69	8,113,768	59,493

*See source footnote (7), page 28.

[40]Table 16, footnote 32.

[41]Table 4, footnote 13.

[42]Table 4, footnote 14.

in a lower price in Region IV. (Table 21 indicates the grains used to produce broilers.) Milo in Region IV went from \$39.71 per ton in 1970 to \$36.34 per ton in 1971. The production of milo in Region IV also went from 16.8 million tons in 1970 to 21.2 million tons in 1971. The increased quantity of milo at a lower price in Region IV was sufficient to over-ride the decrease in the price of corn in Region I as far as the production of the broiler supply for Region I is concerned.

Utah was in much the same position for 1971 as 1970 in producing broilers. In both years broilers were produced in Utah by feeding milo imported from Region II along with protein supplement.

Turkeys

Turkey production in 1971 for Regions II, III, and V is the same as it was in 1970. In these regions all the turkeys consumed in 1971 were grown in the regions of consumption (Table 22).

No turkeys should have been grown in Region I and Region VI in 1971 according to the model. The model shows that for the year 1971 Region IV produced all the turkey for Regions I, IV, and VI. This differs from the year 1970 in which all the turkey was grown in the region in which it was consumed.

In 1970, Regions I and VI produced turkey by feeding corn with protein supplement. In 1971 Region IV had a big increase in milo production which resulted in a lower price as previously mentioned. This enabled Region IV to supply turkey to both Region I and Region VI at a lower cost

Table 21. 1971 Prices--Utilization of feed grains to produce broilers

	Production of Broilers[43] (1,000 Pounds)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	---	---	---	---	---	---	---
Region II	405,784	---	---	---	---	350,331.24	93,693.24
Region III	113,861.31	---	---	---	---	103,854.35	27,775
Region IV	2,949,209.69	---	---	---	---	2,665,355.43	712,827.61
Region V	8,113,768	---	---	716,520.26	---	6,548,143.22	2,006,750.95
Region VI	59,493	---	---	---	---	54,081.95	14,463.78

[43]Table 4, footnote 13.

Table 22. 1971 Prices--Turkey production and consumption[44]

	Consumption* (1,000 Pounds)[46]	Production[45] (1,000 Pounds)[46]					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	52,683	---	---	---	52,683	---	---
Region II	69,186	---	69,186	---	---	---	---
Region III	191,125	---	---	191,125	---	---	---
Region IV	278,458	---	---	---	278,458	---	---
Region V	1,391,321	---	---	---	---	1,391,321	---
Region VI	10,144	---	---	---	10,144	---	---
TOTAL	1,992,917	---	69,186	191,125	341,285	1,391,321	---

*See source footnote (7), page 28.

[44]Table 16, footnote 32.

[45]Table 4, footnote 13.

[46]Table 4, footnote 14.

than these two regions could produce turkey locally. (Table 23 indicates the grains used to produce turkeys.)

Eggs

In 1971 eggs were produced in regions of consumption with the exception of Utah which supplied eggs to California (Table 24). These are similar to the production patterns exhibited in 1970.

Eggs were produced in 1971 by milo and protein supplement fed to laying hens in all regions but Region I (Table 25). In Region I eggs were produced by feeding wheat and protein supplement in 1971. In 1970 Region I used oats instead of wheat, but from 1970 to 1971 the price of oats relative to wheat increased in Region I. The price of oats in Region I went from \$42.96 per ton in 1970 to \$43.96 per ton in 1971, an increase of \$1.00 per ton. The price of wheat declined from \$49.33 per ton in 1970 to \$44.74 per ton in Region I in 1971. These price changes of wheat relative to oats made it less costly to use wheat to produce eggs instead of using oats.

In 1970 Utah produced a larger percent of California's eggs than in 1971. The reason for this decrease was because of the lack of available milo from Region II. Region II feeders fed more milo locally in 1971 than they did in 1970.

Milk

In 1971 milk was produced in the regions of consumption (Table 26).

Table 23. 1971 Prices--Utilization of feed grains to produce turkeys

	Production of Turkeys[47] (1,000 Pounds	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	---	---	---	---	---	---	---
Region II	69,186	---	---	---	---	63,982.89	24,297.3
Region III	191,125	---	---	---	---	176,452.53	67,007.29
Region IV	341,285	---	---	---	---	313,928.14	119,213.22
Region V	1,391,321	---	---	1,184,767.92	---	---	564,889.34
Region VI	---	---	---	---	---	---	---

[47]Table 4, footnote 13.

Table 24. 1971 Prices--Egg production and consumption[48]

	Consumption* (1,000 Dozens)	Production[49] (1,000 Dozens)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	145,292	145,292	---	---	---	---	---
Region II	190,808	---	190,808	---	---	---	---
Region III	527,092	---	---	274,129.85	---	---	252,962.15
Region IV	794,613	---	---	---	794,613	---	---
Region V	3,653,293	---	---	---	---	3,653,293	---
Region VI	27,976	---	---	---	---	---	27,976
TOTAL	5,339,074	145,292	190,808	274,129.85	794,613	3,653,293	280,938.15

*See source footnote (7), page 28.

[48]Table 16, footnote 32.

[49]Table 4, footnote 13.

Table 25. 1971 Prices--Utilization of feed grains to produce eggs

	Production of Eggs[50] (1,000 Dozen)	Produced by feeding the following grains (Tons)					
		Barley	Wheat	Corn	Oats	Milo	Protein
Region I	145,292	---	284,128.3	---	---	---	41,435.38
Region II	190,808	---	---	---	---	362,995.65	49,155.66
Region III	274,129.85	---	---	---	---	524,833.12	71,071.15
Region IV	794,613	---	---	---	---	1,520,597.14	205,914.2
Region V	3,653,293	---	---	---	---	7,325,602.51	992,008.67
Region VI	280,938.15	---	---	---	---	497,404.27	67,356.83

[50] Table 4, footnote 13.

Table 26. 1971 Prices--Milk production and consumption[51]

	Consumption* (1,000 Pounds)	Production[52] (1,000 Pounds)					
		Region I	Region II	Region III	Region IV	Region V	Region VI
Region I	3,183,675	3,183,675	---	---	---	---	---
Region II	4,181,034	---	4,181,034	---	---	---	---
Region III	11,549,794	---	---	11,549,794	---	---	---
Region IV	17,411,808	---	---	---	17,411,808	---	---
Region V	80,052,061	---	---	---	---	80,052,061	---
Region VI	613,002	---	---	---	---	---	613,002
TOTAL	116,991,374	3,183,675	4,181,034	11,549,794	17,411,808	80,052,061	613,002

*See source footnote (7), page 28.

[51]Table 16, footnote 32.

[52]Table 4, footnote 13.

This is the same thing that happened in the year 1970. However, in the year 1971, as contrasted to 1970, all milk was not produced by feeding barley, hay, and protein supplements. Wheat and corn were also used to produce milk in 1971 (Table 27).

Region V had such a big decrease in the price of corn, from \$51.14 per ton in 1970 to \$38.96 per ton in 1971, that corn became a very competitive feed with which to produce milk in Region V.

In 1971 milk was produced in Utah by feeding high protein hay, which makes Utah self-sufficient in supplying all the milk for consumption in the state.

Table 27. 1971 Prices--Utilization of feed grains and hay to produce milk

	Production of Milk[53] (1,000 Pounds	Produced by feeding the following grains and hay (Tons)						
		Barley	Wheat	Corn	Oats	Milo	Hay	Protein
Region I	3,183,675	323,744.83	---	---	---	---	1,273,591	150,166.31
Region II	4,181,034	221,609.58	---	---	---	---	2,349,061.51	---
Region III	11,549,794	328,547	738,715.35	---	---	---	4,444,537	401,710.86
Region IV	17,411,808	---	---	---	---	---	9,535,373.99	1,064,033.15
Region V	80,052,061	---	---	2,988,353.09	---	---	38,744,500	5,285,336.83
Region VI	613,002	---	---	---	---	---	377,708.3	---

[53]Table 4, footnote 13.

CHAPTER VI

SUMMARY

The analysis of results obtained from the model has shown the competitive advantage offerd by lower feed costs and market locations. The competitive advantage varies from year to year for the different types of livestock products. These variations result from changes in cost and levels of production of feed.

The model was set up mainly for consideration of Utah's livestock industry. It is difficult in some of the larger regions such as Region IV and Region V to determine any definite conclusions about an individual state.

The short run is important to the livestock producer, but the big question is, can he succeed in the long run? The "short run" is defined as that period of time in which certain equipment, resources, and commitments of the firm are fixed. Milking facilities would be an example of a fixed factor in the short run for the dairyman. In evaluating the livestock industry for one year, it should be rememberd that one year is the short run. A person cannot enter and leave the livestock industry on a year to year basis. It takes time to obtain the necessary capital for a livestock operation. It also takes experience to run a livestock operation effectively. If the livestock producer is making enough to cover his variable costs in the short run, he will continue to operate. The critical question to him is, can the producer make a profit in the long run?

This analysis helps to point out the importance of relative prices of feed, production levels of feed, and the market demand for livestock products. A change in feed cost of a few dollars per ton in a region can have a big influence on where the product should be produced. An increase in production of a certain feed grain in one region can produce a big effect on the location of livestock product production patterns.

The market demand or population center is very important. The producer who is not located near the consumer has to pay transportation costs to put his product on the market. The producer located nearest the market center may have an economic advantage over the producer further from the market provided costs other than transportation are similar.

Conclusions

The comparative advantage to produce a livestock product is generally in the region of consumption so long as there is feed available in a local area.

Prices and levels of production of feed grains have a significant effect on a producer's ability to compete. From 1970 to 1971 milo production in Region IV increased so that the price of milo relative to other regions decreased. This resulted in Region IV increasing production from 1970 to 1971 in beef and many of the other livestock products.

Utah has a comparative advantage to produce all of its own milk, broilers, eggs and part of its own beef, pork and turkeys for the years 1970 and 1971 according to the model. This is based only on feed ingredient costs.

Milk production according to the model would be one of the most promising enterprises in the livestock industry in Utah. Because of the high protein alfalfa hay produced in Utah, the Utah producer is able to supply milk at a lower cost than some of its competitors. The main market for milk outside Utah would be California in the form of cheese and other milk products.

Egg production in Utah is also a very competitive market with surrounding regions. All of the eggs consumed in Utah should be produced in the State. Utah's best outside market would be California. The ability of the egg producer in Utah to have a comparative advantage in supplying eggs for California depends greatly on the relative price of feeds between these two regions. For the years 1970 and 1971, this comparative advantage was very small.

Broilers, according to the model, should also be grown in Utah for consumption in Utah. In the real world, this isn't happening. In 1970, Utah only produced around 13 percent of the broilers consumed in the State. This would indicate that there is opportunity for expansion in the broiler industry in the state if relative prices of feed grains remain about the same.

The turkey industry in Utah is highly influenced by the opportunity for obtaining relatively cheap milo from Region II. In 1970, Utah should have produced all of the turkey consumed while in 1971 none of it was produced according to the model. Both years' production was based on availability of milo from Region II. In the real world corn and wheat have also been used as grains in the turkey ration.

Pork production in 1970 for the State of Utah was way below its potential output. According to the model, Utah produced all of the pork for consumption for 1970. By the model, there was 96.4 million pounds of pork produced in 1970, compared to the 16.5 million pounds actually produced. According to the model, only 13 million pounds of pork was produced in Utah in 1971. In the real world, Utah produced 20 million pounds. The reason for the decline of production between 1970 and 1971 was the less costly feeds in 1971 in Region IV relative to the feeds in Regions VI and II.

Opportunity in the pork industry in Utah depends largely on the relative feed prices between regions. In the short run, the opportunity for expanding the pork industry in Utah would have to be for supplying more of the pork consumed in the State.

The quantity of beef produced in Utah varied greatly from 1970 to 1971. The reason for this difference was because of the big increase in milo production in Region IV at a relatively lower price.

The comparative advantage in many of the cases cited in this thesis is very small. Many other factors are also involved such as climate, price of land, labor, etc. But through the analysis made in this thesis, these other factors can be compared after the feed cost has been taken into account. This thesis helps to point out how important relative feed costs and location of markets are in determining where a product should be produced.

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APPENDIX

Table 28. 1970--Production and utilization of feed grains and hay by model

Region of Origin	Feed	Production	Utilization	Quantity Transported From Region of Origin	Transported to Region
		(Tons)	(Tons)	(Tons)	
I	Barley	893,592	893,592	---	---
II	Barley	3,227,760	3,227,760	---	---
III	Barley	1,482,624	1,163,433.35	---	---
IV	Barley	3,240,048	1,813,464.54	1,426,583.46	V
V	Barley	830,184	2,256,767.46	---	---
VI	Barley	176,472	176,472	---	---
I	Wheat	982,103	982,103	---	---
II	Wheat	659,352	537,373.94	121,978.06	VI
III	Wheat	665,250	665,250	---	---
IV	Wheat	2,389,317	2,389,317	---	---
V	Wheat	1,523,580	1,523,580	---	---
VI	Wheat	17,928	139,915.06	---	---
I	Corn	134,848	134,848	---	---
II	Corn	1,054,788	1,046,069.28	8,718.72	VI
III	Corn	592,704	592,704	---	---
IV	Corn	56,437,276	39,192,918.33	---	---
V	Corn	56,854,560	20,341,524.13	---	---
VI	Corn	---	8,718.72	---	---
I	Oats	233,888	233,888	---	---
II	Oats	536,112	536,112	---	---
III	Oats	80,800	80,800	---	---
IV	Oats	8,977,696	8,977,696	---	---
V	Oats	4,704,640	---	---	---
VI	Oats	18,560	---	---	---
I	Milo	---	---	---	---
II	Milo	1,161,692	368,182.02	793,509.98	VI
III	Milo	820,512	820,512	---	---
IV	Milo	16,803,164	3,252,690.44	13,550,473.56	V
V	Milo	732,032	14,282,505.56	---	---
VI	Milo	---	793,509.98	---	---
I	Hay	1,597,412	1,597,412	---	---
II	Hay	2,562,580	2,562,580	---	---
III	Hay	4,363,846	4,363,846	---	---
IV	Hay	17,773,188	12,063,561.99	---	---
V	Hay	40,438,582	40,438,582	---	---
VI	Hay	435,735	413,443.3	---	---
I	Protein	---	387,733.29	---	---
II	Protein	---	318,490.09	---	---
III	Protein	---	917,742.01	---	---
IV	Protein	---	2,659,952.5	---	---
V	Protein	---	13,019,808.38	---	---
VI	Protein	---	135,180.05	---	---

Table 29. 1971--Production and utilization of feed grains and hay by model

Region of Origin	Feed	Production	Utilization	Quantity Transported From Region of Origin	Transported to Region
		(Tons)	(Tons)	(Tons)	
I	Barley	1,081,244	323,744.83	328,547	III
II	Barley	3,141,888	221,609.58	---	---
III	Barley	1,382,664	328,547	---	---
IV	Barley	4,390,392	4,390,392	---	---
V	Barley	920,784	---	---	---
VI	Barley	182,664	---	---	---
I	Wheat	1,150,658	1,010,892.65	139,765.35	III
II	Wheat	771,975	771,975	---	---
III	Wheat	598,950	738,715.35	---	---
IV	Wheat	2,902,938	2,902,938	---	---
V	Wheat	1,761,608	1,761,608	---	---
VI	Wheat	18,834	18,834	---	---
I	Corn	219,072	---	---	---
II	Corn	1,145,480	---	---	---
III	Corn	694,848	---	---	---
IV	Corn	75,172,020	32,955,365.58	---	---
V	Corn	77,895,664	33,564,999.72	---	---
VI	Corn	---	---	---	---
I	Oats	130,896	---	---	---
II	Oats	312,448	---	---	---
III	Oats	78,336	---	---	---
IV	Oats	9,004,096	1,045,109.62	---	---
V	Oats	4,471,680	---	---	---
VI	Oats	14,960	---	---	---
I	Milo	---	---	---	---
II	Milo	1,328,796	777,309.78	551,486.22	VI
III	Milo	805,140	805,140	---	---
IV	Milo	21,221,172	9,062,090.27	12,159,081.72	V
V	Milo	1,714,664	1,714,664	---	---
VI	Milo	---	551,486.22	---	---
I	Hay	1,273,591	1,273,591	---	---
II	Hay	2,590,162	2,349,061.51	---	---
III	Hay	4,444,537	4,444,537	---	---
IV	Hay	17,466,606	12,086,979.99	---	---
V	Hay	40,151,603	40,151,603	---	---
VI	Hay	447,296	377,708.3	---	---
I	Protein	---	276,941.44	---	---
II	Protein	---	257,794.78	---	---
III	Protein	---	567,564.31	---	---
IV	Protein	---	3,324,199.41	---	---
V	Protein	---	13,281,095.9	---	---
VI	Protein	---	84,032.17	---	---

Table 30. Production and consumption of livestock products by model, 1970

Region of Origin	Product	Production	Consumption	Quantity Transported From Region of Origin	Transported to Region
		(1,000 Pounds)	(1,000 Pounds)	(1,000 Pounds)	
I	Fed Beef	97,000.19	345,189	---	---
II	Fed Beef	872,663.09	461,655	389,006.11 22,001.98	III VI
III	Fed Beef	---	1,271,741	---	---
IV	Fed Beef	11,088,556.71	2,011,879	248,188.81 882,734.89 7,945,754	I III V
V	Fed Beef	---	7,945,754	---	---
VI	Fed Beef	44,911.02	66,913	---	---
I	Pork	676,811.35	500,846	175,965.35	III
II	Pork	665,993.49	657,746	8,247.49	III
III	Pork	501,962.26	1,816,978	1,130,802.9	III
IV	Pork	4,224,710.9	3,093,908	---	---
V	Pork	14,626,969	14,626,969	---	---
VI	Pork	96,435	96,435	---	---
I	Broilers	308,986	308,986	---	---
II	Broilers	405,784	405,784	---	---
III	Broilers	1,120,943	1,120,943	---	---
IV	Broilers	1,633,142	1,633,142	---	---
V	Broilers	8,113,768	8,113,768	---	---
VI	Broilers	59,493	59,493	---	---
I	Turkeys	52,683	52,683	---	---
II	Turkeys	69,186	69,186	---	---
III	Turkeys	191,125	191,125	---	---
IV	Turkeys	278,458	278,458	---	---
V	Turkeys	1,391,321	1,391,321	---	---
VI	Turkeys	10,144	10,144	---	---
I	Eggs	145,292	145,292	---	---
II	Eggs	190,808	190,808	---	---
III	Eggs	137,432.78	527,092	---	---
IV	Eggs	794,613	794,613	---	---
V	Eggs	3,653,293	3,653,293	---	---
VI	Eggs	417,635.22	27,976	389,659.22	III
I	Milk	3,183,675	3,183,675	---	---
II	Milk	4,181,034	4,181,034	---	---
III	Milk	11,549,794	11,549,794	---	---
IV	Milk	17,411,808	17,411,808	---	---
V	Milk	80,052,061	80,052,061	---	---
VI	Milk	613,002	613,002	---	---

Table 31. Production and consumption of livestock products by model, 1971

Region of Origin	Product	Production	Consumption	Quantity Transported From Region of Origin	Transported to Region
		(1,000 Pounds)	(1,000 Pounds)	(1,000 Pounds)	
I	Fed Beef	---	345,189	---	---
II	Fed Beef	---	461,655	---	---
III	Fed Beef	---	1,271,741	---	---
				345,189	I
				461,655	II
IV	Fed Beef	9,487,917.16	2,011,879	1,271,741	III
				5,330,540.16	V
				66,913	VI
V	Fed Beef	2,615,213.84	7,945,754	---	---
VI	Fed Beef	---	66,913	---	---
I	Pork	500,846	500,846	---	---
II	Pork	531,681.11	657,746	---	---
III	Pork	---	1,816,978	---	---
				126,064.89	II
IV	Pork	5,120,403.92	3,093,908	1,816,978	III
				83,453.03	VI
V	Pork	14,626,969	14,626,969	---	---
VI	Pork	12,981.97	96,435	---	---
I	Broilers	---	308,986	---	---
II	Broilers	405,784	405,784	---	---
III	Broilers	113,861.31	1,120,943	---	---
IV	Broilers	2,949,209.69	1,633,142	308,986	I
				1,007,081.69	III
V	Broilers	8,113,768	8,113,768	---	---
VI	Broilers	59,493	59,493	---	---
I	Turkeys	---	52,683	---	---
II	Turkeys	69,186	69,186	---	---
III	Turkeys	191,125	191,125	---	---
IV	Turkeys	341,285	278,458	52,683	I
				10,144	VI
V	Turkeys	1,391,321	1,391,321	---	---
VI	Turkeys	---	10,144	---	---
I	Eggs	145,292	145,292	---	---
II	Eggs	190,808	190,808	---	---
III	Eggs	274,129.85	527,092	---	---
IV	Eggs	794,613	794,613	---	---
V	Eggs	3,653,293	3,653,293	---	---
VI	Eggs	280,938.15	27,976	252,962.15	III
I	Milk	3,183,675	3,183,675	---	---
II	Milk	4,181,034	4,181,034	---	---
III	Milk	11,549,794	11,549,794	---	---
IV	Milk	17,411,808	17,411,808	---	---
V	Milk	80,052,061	80,052,061	---	---
VI	Milk	613,002	613,002	---	---

Table 32. 1970, Regional weighted average prices received by farmers (13)*

Regions	Beef	Pork	Broilers	Turkey	Eggs[54]	Milk
	- - - - - - - - - - - - - -		(Dollars Per Cwt.)	- - - - - - - - - - - - - -		
I	28.14	23.68	17.58	23.23	35.50	5.84
II	29.52	22.84	16.55	22.19	39.60	5.72
III	29.30	23.50	16.70	21.90	33.80	5.35
IV	29.12	25.53	13.99	22.40	33.40	5.24
V	27.87	22.92	13.28	24.74	41.70	5.89
VI	27.90	22.40	17.00	22.10	36.00	5.48

*Source: Agricultural Prices--1970, United States Department of Agriculture.

[54]Dollars per 100 dozen eggs.

Table 33. 1971, Regional weighted average prices received by farmers (14)*

Regions	Beef	Pork	Broilers	Turkey	Eggs[55]	Milk
	- - - - - -	- - - - - -	(Dollars Per Cwt.)	- - - - - -	- - - - - -	- - - - - -
I	30.09	18.42	18.22	22.78	26.02	5.97
II	31.92	17.73	17.02	25.01	31.65	5.92
III	31.60	18.40	17.10	21.90	25.50	5.54
IV	31.24	17.42	14.40	21.06	25.43	5.38
V	29.40	17.68	13.49	23.16	34.36	6.07
VI	30.10	16.40	16.99	22.00	23.90	5.65

*Source: Agricultural Prices--1971, United States Department of Agriculture.

[55]Dollars per 100 dozen eggs.

Table 34. 1970, Regional weighted average feed price received by farmers*

Regions	Barley	Wheat	Corn	Oats	Milo	Hay	Protein[56]
	- - - - - -	- - - - - -	- - - - - -	(Dollars Per Ton)	- - - - - -	- - - - - -	- - - - - -
I	41.85	49.33	57.17	42.96	---	25.50	129.25
II	36.86	41.45	47.22	37.68	43.53	24.52	121.36
III	50.83	47.33	56.79	48.75	51.80	30.00	118.67
IV	35.90	43.90	46.15	37.39	39.71	21.06	108.90
V	38.33	44.63	51.14	46.86	42.61	26.20	114.17
VI	44.58	46.33	---	48.75	---	25.00	127.50

*See source footnote (13), page 84.

[56]Price paid by farmers.

Table 35. 1971, Regional weighted average feed price received by farmers*

Regions	Barley	Wheat	Corn	Oats	Milo	Hay	Protein[57]
	- - - - - - - -	- - - - - - - -	- - - - - - - -	(Dollars Per Ton)	- - - - - - - -	- - - - - - - -	- - - - - - - -
I	41.83	44.74	48.39	43.96	---	30.25	131.67
II	40.63	41.34	42.84	40.32	40.19	28.75	123.50
III	55.42	54.33	53.21	54.38	48.60	31.50	124.17
IV	34.29	43.48	37.71	35.14	36.34	21.89	109.20
V	42.62	46.53	38.96	44.09	33.53	27.54	116.17
VI	46.67	45.67	---	51.25	---	30.00	127.83

*See source footnote (14), page 85.

[57]Price paid by farmers.

Table 36. Truck transportation costs for whole milk (15)*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	- - - - - - - - - - - - - - - - - (Dollars Per Cwt.) - - - - - - - - - - - - - - - - -					
I	---	2.23	1.75	3.13	3.54	2.70
II	2.23	---	2.00	1.16	1.80	1.45
III	1.75	2.00	---	2.73	3.54	1.67
IV	3.13	1.16	2.73	---	1.00	2.37
V	3.54	1.80	3.54	1.00	---	3.21
VI	2.70	1.45	1.67	2.37	3.21	---

*Source: Ph.D. dissertation by Harry G. Witt, University of Florida, 1970.

Table 37. Rail transportation costs for fresh eggs*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	(Cents Per Dozen)[58]					
I	--	5.75	2.65	6.19	6.34	2.26
II	2.39	---	2.39	2.86	3.85	2.03
III	2.65	5.75	---	6.19	6.34	2.12
IV	6.19	2.39	6.19	---	2.37	4.77
V	2.78	3.85	2.78	2.37	---	6.11
VI	2.26	2.03	2.12	4.77	6.11	---

*See source footnote (15), page 88.

[58] Figured on 1273.89 dozen eggs per ton, or 1.57 pounds per dozen.

Table 38. Cost of transporting turkey ready to cook in live weight equivalents*

Regions	Region I	Region II	Region III	Region IV	Region V	Region IV
	- - - - - - - - -	- - - - - -	- - (Dollars Per Cwt.)	- - - - - -	- - - - - -	- - - - - -
I	---	1.7951	1.5265	2.1552	2.5223	1.5055
II	1.7951	---	1.6695	1.1515	1.5666	1.1006
III	1.5265	1.6695	---	2.1299	2.5075	1.2063
IV	2.1552	1.1515	2.1299	---	1.0957	1.5749
V	2.5223	1.5666	2.5075	1.0957	---	1.9926
VI	1.5055	1.1006	1.2063	1.5749	1.9926	---

*Source: Texas A&M formula, conversion factor from ready to cook to live weight equivalent = live weight X .800 X (ready to cook) rate. See source footnote (12), page 48.

Table 39. Cost of transporting broilers ready to cook in live weight equivalents*

Regions	Region I	Region II	Region III	Region VI	Region V	Region VI
	- - - - - - - - - - - - - - - - -	(Dollars Per Cwt.)	- - - - - - - - - - - - - - - - -			
I	---	1.6155	1.3738	1.9397	2.2701	1.3550
II	1.6155	---	1.5026	1.0364	1.4099	.9905
III	1.3738	1.5026	---	1.9169	2.2567	1.0857
IV	1.9397	1.0364	1.9169	---	.9862	1.4174
V	2.2701	1.4099	2.2567	.9862	---	1.7934
VI	1.3550	.9905	1.0857	1.4174	1.7934	---

*Source: Texas A&M formula, conversion factor from ready to cook to live weight equivalent = live weight X .720 X (ready to cook) rate. See source footnote (12), page 48.

Table 40. Cost of transporting pork carcasses in live weight equivalent*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	(Dollars Per Cwt.)					
I	---	1.4181	1.2059	1.7026	1.9926	1.1894
II	1.4181	---	1.3189	.9097	1.2376	.8694
III	1.2059	1.3189	---	1.6826	1.9809	.9530
IV	1.7026	.9097	1.6826	---	.8656	1.2442
V	1.9926	1.2376	1.9809	.8656	---	1.5742
VI	1.1894	.8694	.9530	1.2442	1.5742	---

*Source: Texas A&M transportation formula, conversion factor from carcass to live weight equivalent = live weight X .632 X carcass rate. See source footnote (12), page 48.

Table 41. Cost of transporting beef carcasses in live weight equivalent*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	- - - - - - - - - - - - - - - - - - - (Dollars Per Cwt.) - - - - - - - - - - - - - - - - - -					
I	---	1.3082	1.1124	1.5706	1.8381	1.0971
II	1.3082	---	1.2167	.8392	1.1417	.8020
III	1.1124	1.2167	---	1.5522	1.8273	.8791
IV	1.5706	.8392	1.5522	---	.7985	1.1477
V	1.8281	1.1417	1.8273	.7985	---	1.4521
VI	1.0971	.8020	.8791	1.1477	1.4521	---

*Source: Texas A&M formula, conversion factor from carcass to live weight equivalent = live weight X .583 X carcass rate. See source footnote (12), page 48.

Table 42. Truck feed grain transportation rates*

Regions	Region I	Region II	Region III	Region IV	Region V	Region VI
	- - - - - - - - - - - - - - - -	(Dollars Per Ton)	- - - - - - - - - - - - - - - -			
I	---	14.37	11.34	18.43	22.56	11.05
II	14.37	---	12.95	7.12	11.79	4.97
III	11.34	12.95	---	18.14	22.39	6.69
IV	18.43	7.12	18.14	---	6.49	11.83
V	22.56	11.79	22.39	6.49	---	16.49
VI	11.05	4.97	6.69	11.83	16.49	---

*Derived from Texas A&M formula. See source footnote (12), page 48.